

Claims

We claim:

1. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution including an aqueous oxidizer wherein said aqueous oxidizer comprises hydroxylamine nitrate and nitric acid.
2. A composition as in claim 1 wherein said aqueous oxidizer comprises hydroxylamine nitrate in an amount of approximately 3% of an approximately 82% solution, and nitric acid in an amount of approximately 0.08% of an approximately 28% solution.
3. A composition as in claim 2 wherein said aqueous oxidizer further comprises sufficient acid such that the pH of said aqueous oxidizer is in the range from approximately 2.6 to approximately 2.7.
4. A composition as in claim 1 further comprising an abrasive.
5. A composition as in claim 4 wherein said abrasive is aqueous colloidal silica.
6. A composition as in claim 5 wherein said aqueous colloidal silica comprises approximately 25 weight percent to approximately 33.5 weight percent colloidal silica having a particle size in the range from approximately 20 nanometers to approximately 120 nanometers and having an average particle size in the range from approximately 71 nanometers to approximately 73 nanometers.
7. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution of aqueous oxidizer and aqueous colloidal silica abrasive wherein said composition comprises approximately 90% aqueous oxidizer as in claim 3 and approximately 10% aqueous colloidal silica as in claim 6.

8. A composition as in claim 1 further comprising benzotriazole.
9. A composition as in claim 8 wherein said aqueous oxidizer comprises hydroxylamine nitrate in an amount of approximately 1.2% of an approximately 82% solution, nitric acid in an amount of approximately 0.024% of an approximately 28% solution, and benzotriazole in an amount of approximately 8.0% of a 0.2% solution.
10. A composition as in claim 9 wherein said aqueous oxidizer further comprises sufficient acid such that the pH of said aqueous oxidizer is in the range from approximately 2.8 to approximately 2.9.
11. A composition as in claim 8 further comprising an abrasive.
12. A composition as in claim 11 wherein said abrasive is aqueous colloidal silica.
13. A composition as in claim 12 wherein said aqueous colloidal silica comprises approximately 25 weight percent to approximately 33.5 weight percent colloidal silica having a particle size in the range from approximately 20 nanometers to approximately 120 nanometers and having an average particle size in the range from approximately 71 nanometers to approximately 73 nanometers.
14. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution of aqueous oxidizer and aqueous colloidal silica abrasive wherein said composition comprises approximately 50% aqueous oxidizer as in claim 10 and approximately 15% aqueous colloidal silica as in claim 13.
15. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution including an aqueous oxidizer wherein said aqueous oxidizer comprises ammonium nitrate and benzotriazole.
16. A composition as in claim 15 wherein said aqueous oxidizer comprises approximately 6.0% ammonium nitrate, and benzotriazole in an amount of approximately 0.6% of an approximately

0.2% solution.

17. A composition as in claim 16 wherein said aqueous oxidizer further comprises sufficient acid such that the pH of said aqueous oxidizer is in the range from approximately 5.1 to approximately 5.5.

18. A composition as in claim 15 further comprising an abrasive.

19. A composition as in claim 18 wherein said abrasive is aqueous colloidal silica.

20. A composition as in claim 19 wherein said aqueous colloidal silica comprises approximately 25 weight percent to approximately 33.5 weight percent colloidal silica having a particle size in the range from approximately 20 nanometers to approximately 120 nanometers and having an average particle size in the range from approximately 71 nanometers to approximately 73 nanometers.

21. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution including an aqueous oxidizer and aqueous colloidal silica abrasive wherein said composition comprises from approximately 30% to approximately 50% aqueous oxidizer as in claim 17 and from approximately 10% to approximately 20% aqueous colloidal silica as in claim 20.

22. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution including an aqueous oxidizer wherein said aqueous oxidizer comprises aluminum nitrate.

23. A composition as in claim 22 wherein said aqueous oxidizer comprises approximately 6% aluminum nitrate.

24. A composition as in claim 23 wherein said aqueous oxidizer further comprises sufficient acid such that the pH of said aqueous oxidizer is in the range from approximately 5.1 to approximately 5.5.

25. A composition as in claim 22 further comprising an abrasive.
26. A composition as in claim 25 wherein said abrasive is aqueous colloidal silica.
27. A composition as in claim 26 wherein said aqueous colloidal silica comprises approximately 25 weight percent to approximately 33.5 weight percent colloidal silica having a particle size in the range from approximately 20 nanometers to approximately 120 nanometers and having an average particle size in the range from approximately 71 nanometers to approximately 73 nanometers.
28. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution of aqueous oxidizer and aqueous colloidal silica abrasive wherein said composition comprises approximately 50% aqueous oxidizer as in claim 24 and approximately 10% aqueous colloidal silica as in claim 27.
29. A composition as in claim 15 further comprising hydrazine solution.
30. A composition as in claim 29 wherein said aqueous oxidizer comprises approximately 3.0% ammonium nitrate, benzotriazole in an amount of approximately 0.06% of an approximately 0.2% solution, and approximately 0.5% of hydrazine solution.
31. A composition as in claim 30 wherein said aqueous oxidizer further comprises sufficient acid such that the pH of said aqueous oxidizer is in the range from approximately 5.7 to approximately 6.5.
32. A composition as in claim 29 further comprising an abrasive.
33. A composition as in claim 32 wherein said abrasive is aqueous colloidal silica.
34. A composition as in claim 33 wherein said aqueous colloidal silica comprises approximately 20 weight percent colloidal silica having a particle size in the range from approximately 40 nanometers to approximately 150 nanometers and having an average particle size of approximately 60 nanometers.

35. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution of aqueous oxidizer and aqueous colloidal silica abrasive wherein said composition comprises approximately 37.4% aqueous oxidizer as in claim 31 and approximately 17% aqueous colloidal silica as in claim 34.

36. A composition for chemical mechanical planarization of tantalum/tantalum nitride barrier/adhesion layers comprising an aqueous solution of aqueous oxidizer and aqueous colloidal silica abrasive wherein said composition comprises approximately 50% aqueous oxidizer as in claim 10 and approximately 25% aqueous colloidal silica, wherein said aqueous colloidal silica comprises approximately 20 weight percent colloidal silica having a particle size in the range from approximately 40 nanometers to approximately 150 nanometers and having an average particle size of approximately 60 nanometers.

37. A method of chemical mechanical planarization comprising:

- a) providing a barrier/adhesion layer of Ta/TaN overlying a dielectric layer; and,
- b) providing a chemical mechanical planarization composition wherein said composition includes, in aqueous solution, at least one oxidizer, at least one nitrate and at least one abrasive; and,
- c) planarizing said barrier/adhesion layer by rotating a polishing pad in contact with said barrier/adhesion layer while having said chemical mechanical planarization composition therebetween.

38. A method as in claim 37 wherein said at least one oxidizer and said at least one nitrate are selected from the group consisting of hydroxylamine nitrate, nitric acid, ammonium nitrate, aluminum nitrate, hydrazine solution and mixtures thereof.

39. A method as in claim 38 further comprising benzotriazole.

40. A method as in claim 38 wherein said oxidizer is the oxidizer of claim 1, 2, 3, 8, 9, 10, 15,

16, 17, 22, 23, 24, 29, 30 or 31.

41. A method as in claim 38 wherein said chemical mechanical planarization composition is the composition of claim 7, 14, 21, 28, 35 or 36.